SCIENCE

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CONTENTS:

☞MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson N. Y.

UNITED STATES NAVAL OBSERVATORY.

ASTRONOMERS everywhere will be gratified by the announcement from Washington that Secretary Long has appointed a board to visit, examine and report upon the U. S. Naval Observatory. The work of this body will be of such far-reaching importance—perhaps determining the character of our government astronomy for fifty years to come—as to make it worthy of the serious consideration of the public. Whether it shall prove as nugatory as the efforts heretofore made to improve the administration must depend upon the wisdom with which the board executes its difficult and delicate task.

We believe a grave mistake will be made if the board confines itself to matters of detail and merely points out the features in which the administration can be improved. We have had plenty of such criticism in the past and always without any important result. The subject should be approached from a broader point of view, taking in its scope the whole history of the institution, past and prospective. What we are concerned with are the work and results of the most richly endowed and liberally supported astronomical observa-

tory in the world. The funds for its support come from the pockets of our taxpayers, and the latter, speaking through our astronomers as their mouthpiece, should be satisfied with nothing less than that the work done by the institution shall correspond to the liberality with which they are supporting it. The fact that our country has a larger proportion of the ablest astronomers of the world than any other, not excepting even Germany, leaves us without any excuse if our national observatory fails to be completely up to the present time.

For more than fifty years we have been trying an experiment in astronomical administration which no other nation ever thought of trying and which we ourselves have never tried in any other field, that of managing a great national observatory like a naval station. One of the most important questions is whether this experiment, taking the whole fifty years together, can be called a success. This question can be answered only by a critical examination of the work of the institution, as found in its volumes of published observations and official reports. In this connection it will be wise to review the laudable efforts made from time to time to improve the administration and determine the causes of their success or failure.

When the subject is considered from this point of view it is a serious question whether any other than an adverse conclusion can be reached. It is true that excellent work has now and then been done at the observatory and that this, taken in connection with the favorable impression made by the splendor of its new buildings, prepossesses the public, which never looks below the surface in its favor. But, as was very clearly pointed out by the National Academy of Sciences in a report in 1885, this good work has been mostly the voluntary work of individuals who happened to be attached to the institution and acted on their own initiative. The part of the administration was only to get the men together and procure them facilities for work.

It should also be remembered that even this work is not by any means a permanent feature of the institution. If we take away from the latter such work as that of Seers Cook Walker in investigating the motions of Neptune, and of Professor Asaph Hall in discovering the satellites of Mars and in investigating the motions of other satellites, what have we left? If anything but a heterogeneous collection of observations and researches, sometimes intermitted entirely and sometimes carried on with vigor, sometimes devoted to one object, sometimes to another, sometimes able and sometimes useless, generally of the most perfunctory kind, nearly always with more or less imperfect instruments and with little evidence of any concerted plan, we hope the board will find it out.

An excellent text will be found in the recent catalogue of stars by Professor Eastman, which, we are told in the preface, has occupied two-thirds of the observatory force for a period of more than thirty years. What should the committee say when it compares the unflagging zeal and persistence of the author with the imperfections of the instrument he had to use?

In the same class may come the more re-

cent work of Professor George A. Hill with the prime vertical transit. There can be no question of the zeal and industry with which Mr. Hill has for five years continued a series of observations bearing on one of the most important problems in exact astronomy with which we are dealing to-day. Yet the results of his work so far as published show now and then anomalies and irregularities leading to the suspicion that there is something wrong about the instrument. The cause can be found only by critical investigation. It would certainly be very regrettable if such rare qualities as those of Mr. Hill should fail to be productive of their best results through adverse circumstances which would be speedily remedied under a proper system of administration; and we hope the Committee will either demonstrate that the suspected defects of the work are unreal, or show their cause if they exist.

THE DIFFRACTION PROCESS OF COLOR PHOTOGRAPHY.

THE production of color by photography has been accomplished in two radically different ways up to the present time. In one, the so-called Lippman process, the waves of light form directly in the photographic film laminæ of varying thickness, depending on the wave-length or color of the light. These thin laminæ show interference colors in reflected light in the same way that the soap bubble does, and these colors approximate closely the tints of the original. The technical difficulties involved in this process are so great that really very few satisfactory pictures have ever been made by it. The other, or three-color process, has been developed along several distinct lines; the most satisfactory results having been produced by Ives with his stereoscopic 'Kromskop,' in which the reproduction is so perfect that in the case of still-life subjects it would be almost impossible to distinguish between the picture and the original seen through a slightly concave lens. The theory of the three-color method is so well known that it will be unnecessary to devote any space to it, except to remind the reader of the two chief ways in which the synthesis of the finished picture is effected from the three negatives. We have, first, the triple lantern and the Kromscope, in which the synthesis is optical, there being a direct addition of light to light in the compound colors, yellow being produced, for example, by the addition of red and green. The second method is illustrated by the modern trichromic printing in pigments. Here we do not have an addition of light to light, and, consequently, cannot produce yellow from red and green, having to produce the green by a mixture of yellow and blue. Still a third method, that of Joly & McDonough, accomplishes an optical synthesis on the retina of the eye, the picture being a linear mosaic in red, green and blue, the individual lines being too fine to be distinguished as such.

The diffraction process, which I have briefly described in the April number of the London, Edinburgh and Dublin *Philosophical Magazine*, is really a variation of the three-color process, though it possesses some advantages which the other methods do not have, such as the complete elimination of colored screens and pigments from the finished picture, and the possibility of printing one picture from another. The idea of using a diffraction grating occurred to me while endeavoring to think of some way of impressing a surface with a structure capable of sending light of a certain color to the eye, and then superposing on this a second structure capable of sending light of another color, without in any way